

NON-PUBLIC?: N
ACCESSION #: 8807200220
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 2 PAGE: 1 of 7

DOCKET NUMBER: 05000410

TITLE: High Reactor Vessel Water Level Caused by Failure of Feedwater Control
Valve Feedback Linkage Results in Reactor Scram
EVENT DATE: 06/02/88 LER #: 88-019-00 REPORT DATE: 07/11/88

OPERATING MODE: 1 POWER LEVEL: 026

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Robert E. Jenkins, Assistant Supervisor Technical Support
TELEPHONE #: 315-349-4220

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: SJ COMPONENT: FFC MANUFACTURER: A590
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: On June 2, 1988 at 2323 hours, Nine Mile Point Unit 2 (NMP2) experienced a reactor scram at approximately 25.5% of rated thermal power. The scram was caused by turbine control valve fast closure resulting from reactor water level exceeding the high level turbine trip setpoint. The high water level was caused by sudden increase in reactor feedwater flow when a feedwater flow control valve went to the full open position. After the scram, operators brought the plant to a stable water level within 65 seconds.

The cause of the event has been determined to be failure of the position feedback linkage of the "A" feedwater level control valve. Failure of the feedback linkage caused the valve to ramp to full open resulting in excess flow to the reactor vessel. The root cause is equipment failure due to inadequate design of the feedwater level control valve position feedback assembly.

Immediate corrective action was for operators to complete an orderly plant shutdown. A spherical bearing in the "A" feedwater control valve which

failed was replaced and the bearings for the "B" and "C" control valves were checked for wear. A problem report was initiated to modify a retainer ring in the valve feedback linkage so that failure of the spherical bearing will not lead to a complete separation of the feedback control linkage. A modification request has been initiated requesting that the Engineering Department evaluate and make appropriate changes to upgrade the reliability of the linkages. Preventive Maintenance Procedures are being developed to implement activities which will improve the reliability of 2FWS-LV10A-C.

(End of Abstract)

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I. DESCRIPTION OF EVENT

On June 2, 1988 at 2323 hours, Nine Mile Point Unit 2 (NMP2) experienced a reactor scram from approximately 25.5% of rated thermal power. The scram was caused by reactor water level reaching the high level turbine trip setpoint (Level 8, 202.3 inches). The main turbine and "A" feedwater pump tripped at Level 8 as designed. The "B" and "C" feedwater pumps were not in operation at the time of the event. A reactor scram occurred due to turbine control valve fast closure.

Prior to the scram, the reactor was operating at approximately 24% of rated thermal power. Operators in the control room observed that reactor water level was unexpectedly increasing. The plant was using the "A" feedwater string with the recirculation pumps operating in the down shifted (slow) mode. Reactor water level increased to the Level 8 setpoint where the main turbine and "A" feedwater pump tripped, as designed. The increase in "cooler" feedwater in the reactor vessel also caused reactor power to increase to a peak of approximately 25.5% of rated thermal power at the time of the scram.

Reactor water level reached a peak level of approximately 211 inches several seconds after the scram occurred and then started to decrease. When reactor level started to decrease, the "A" Feedwater pump was restarted and tripped a second time on Level 8. Operators proceeded to close 2FWS-MOV47A in the main "A" feedwater line to isolate this flow path. Then, as reactor water level decreased, operators restarted the "A" feedwater pump and controlled vessel level through the high pressure low flow feedwater path with 2FWS-FV55A acting as a reactor water level control valve. The lowest water level of the event was 168 inches, well above the Level 3 (Low Level) setpoint. The outboard main steam line isolation valves were then manually closed to control vessel cooldown rates.

Operators noted that feedwater level control valve 2FWS-LV10A had indicated full shut throughout the event. An operator was dispatched to 2FWS-LV10A to

determine its position. The operator observed that the valve was in fact, fully open with the position feedback linkage dangling. The mechanical failure of the position feedback linkage caused a downscale position feedback signal and full close indication signal. The feedwater level control valve reacted as designed by opening to the full open position while trying to match valve position with position demand.

Operators in the control room then continued to carry out a normal scram recovery per Operating Procedure, N2-OP-101C, "Scram Recovery". There were no other components or systems which were inoperable and/or out of service which contributed to the event. No plant systems or other component failures resulted from this event.

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II. CAUSE OF EVENT

The immediate cause of the event was the failure of the position feedback linkage. Separation of the feedwater level control valve, 2FWS-LV10A, position feedback linkage caused the valve to ramp to full open, resulting in excess flow to the reactor vessel.

The root cause of the event was equipment failure due to inadequate design of the valve position feedback assembly. Failure of a spherical bearing assembly by separation of the ball from its outer race resulted in separation of the valve feedback linkage (Figure 1). A retainer ring designed to retain the spherical bearing in its outer race failed to perform this function. Upon separation of the two, the spherical bearing ball alone is small enough to fit through the retaining ring. (Figure 2).

The position feedback linkages for the 2FWS-LV10A through C were modified in November and December of 1987 to minimize the vibration transmitted to the position transducer due to feedwater piping vibration. Installation of the spherical bearings was part of this modification. The design inadequacy appears to be a combination of inappropriate material specification and misapplication of the design function of the spherical bearing. The bearing utilized a hardened ball with a carbon steel race making it susceptible to race failure. The bearing was also positioned to receive axial loads and not radial loads as is normally the case with spherical bearings.

III. ANALYSIS OF EVENT

The NMP2 Final Safety Analysis Report (FSAR) Section 15.1.2 discusses feedwater controller failure to maximum demand (i.e., full open). The consequences of the event discussed in the FSAR do not result in any

temperature or pressure transients in excess of the criteria for which the fuel, pressure vessel, or containment are designed. Thus, these barriers will maintain their integrity function as designed and no safety consequences would result. The actual event is bounded by the event discussed in the FSAR. Thus, no adverse safety consequences resulted from this event.

The total duration of the event from the start of the abnormal feedwater transient until reactor water level was stabilized by closing 2FWS-MOV47A and using 2FWS-LV55A for level control was approximately 65 seconds.

IV. CORRECTIVE ACTIONS

Immediate corrective actions were to follow the scram recovery procedure for shutdown of the plant, and continue the investigation to determine the cause of the event.

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Additional corrective actions are as follows:

1. A problem report was initiated to modify the retainer ring so that the spherical bearing ball will not pass through it. Thus, if the ball bearing were to separate from its outer race, the valve feedback linkage would not separate. A modified retainer ring has been installed in all of the feedwater flow control valve feedback linkages.
2. The spherical bearing assembly in 2FWS-LV10A was replaced per work request WR 138603. The spherical bearings for the other two feedwater control valves were inspected and found to be in satisfactory condition.
3. A modification request has been initiated requesting that the Engineering Department evaluate and make the appropriate changes to upgrade the reliability of the control feedback linkages.
4. A list of recommended preventative maintenance activities to improve the reliability of 2FWS-LV10A-C has been developed. Procedures are currently being prepared to implement these recommended preventive maintenance activities at NMP2. One of these recommendations is a monthly visual check of the valve actuator assembly.

V. ADDITIONAL INFORMATION

A. Identification of Components Referred to in this LER:

IEEE 803 IEEE 805
Component EHS Funct System ID

2FWS-LV10 LCV SJ
Spherical Bearing N/A SJ

B. Previous similar events:

There has been one previous similar event involving the failure of a feedwater control valve feedback linkage. However, that event involved a different valve 2FWS-LV55 and failure mode (vibrational related). Details of the event may be found in LER 87-31.

C. Failed component identification:

The spherical bearing which failed is a COM-6 spherical bearing manufactured by the Aurora Bearing Company.

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Figure 1
For 2FWS-LV10 Feedwater Control Valves - Lower Front View

FIGURE OMITTED - NOT KEYABLE (DRAWING)

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Figure 2
Retainer Ring Design Prior to Modification

FIGURE OMITTED - NOT KEYABLE (DRAWING)

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Figure 3
Retainer Ring Design After Modification

FIGURE OMITTED - NOT KEYABLE (DRAWING)

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NIAGARA NMP 37803
MOHAWK

NINE MILE POINT-UNIT 2/P.O. BOX 63, LYCOMING, NY 13093/TELEPHONE
(315)343-2110

July 11, 1988

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

RE: Docket No. 50-410
LER 88-19

Gentlemen:

In accordance with 10 CFR 50.73, we hereby submit the following
Licensee Event Report:

LER 88-19 is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv),
"Any event or condition that resulted in manual or automatic
actuation of any Engineered Safety Feature (ESF), including
the Reactor Protection System (RPS)."

A 10FR50.72(b)(2)(ii) report was made at 0005 hours on June 2, 1988.

This report was completed in the format designated in NUREG-1022,
Supplement 2, dated September 1985.

Very truly yours,
/s/ J. L. Willis
J. L. Willis
General Superintendent
Nuclear Generation
JLW/CDS/mjd
Attachments

cc: Regional Administrator, Region 1
Sr. Resident Inspector, W. A. Cook

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